REMARKS

Applicant herein submits supplemental remarks in light of the amendment of the claims.

Status of the Claims

Claims 1 and 3-4 are pending in the application.

Claims 1 and 3-4 have been amended to correct grammatical and idiomatic errors. Furthermore, the claims have been amended for clarity. The amendments to the claims do not contain, nor constitute new matter.

In the previous Response and Amendment filed September 22, 2011, Applicant made amendments to the claims in error. The current claim listing is fully supported by the original specification and claims.

Rejections Under 35 U.S.C § 112

Applicant addressed the rejections under 35 U.S. C. §112, in the Response of September 22, 2011. However, Applicant repeats those responses herein in the interest of completeness and clarity.

The Examiner has rejected claims 1, 3 and 4 under U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. It is the Examiner's position that the subject matter of the claims was not disclosed in a way that conveyed that one skilled in the art was in possession of the invention at the time of filing. In particular, the Examiner states that the phrase "metal carbonitride hard coat layer" is not supported by the specification. Applicant notes that claim 1 has been amended to remove this phrase. As such, the Examiner's rejection is now moot, and should be withdrawn.

Claims 1, 3 and 4 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically it is the Examiner's position that the claims, as drafted, are generally narrative and indefinite, and fail to conform to current U.S. practice. Applicant has amended the claims for clarity and to correct grammatical and idiomatic errors. No new matter was added.

Rejections Under 35 U.S.C § 103

Applicant addressed the rejections under 35 U.S. C. §103(a) in the prior response. However, Applicant hereby amended those remarks in light of the altered claim amendments. As such, kindly accept the following arguments in place of those made in the Response of September 22, 2011.

Claims 1 and 3-4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,725,932 to Iio et al.

The present invention, as embodied in claim 1, recites a cemented carbide material that is used as a substrate for a surface coated gear cutting tool. This cemented carbide material includes a WC-βt-Co based cemented carbide which includes a βt solid solution and a Co element. The βt solid solution is further selected from the following: WC, TiC, TiN and either or both of Ta carbonitride and Nb carbonitride. A critical element of the present invention requires that the Nb content (D_{Nb}) and the Ta content (D_{Ta}) of the βt solution be provided for in the following ratio $D_{Nb}/(D_{Nb}+D_{Ta}) \geq 0.7$. The present invention also discloses that in the carbide the WC and βt elements form a harder phase, while the Co element forms a binder phase. Additionally, claim 1 describes a compact formed of the carbide material that has been sintered in a nitrogen atmosphere. The resulting carbide is the product of specific ranges and ratios of the elements combined with specific processing requirements. For example, the content of Co is 12-17 wt%, the WC is in a range of 15 to 20 wt%, and both Ta and Nb are in the range of 5 to 7 wt%. Combining these elements and compounds in specific ratios within given ranges results in a material having superior fracture toughness relative to the cited prior art reference.

In contrast, the cited prior art reference merely discloses a WC based cemented carbide comprising 2-15 wt% Co and/or Ni as a biding phase along with 0.2-20 wt% Ti and Ta and a W-Ti-Ta-C (βt) solid solution. While it is clear that there are overlaps with the ranges disclosed in claim 1, it is obvious that the complete invention as described in claim 1 is not taught by Iio. Furthermore, there is no obvious modification of Iio that teaches the complete invention as described in claim 1.

For instance, it is the Examiner's position that the ratio described by the formula $D_{Nb}/(D_{Nb}+D_{Ta}) \geq 0.7$ in claim 1 is satisfied by the overlapping disclosures of the prior art.

Specifically, the Examiner seeks to demonstrate that the prior art recites that the ratio between the Nb and Ta is between 0 and 1. Iio allows for Ta or Nb to be substituted for one another. However, the critical disclosure of claim 1 is the ratio of Nb to Ta when they are both present. In essence, the formula requires that when both materials are present that Nb be in greater supply than Ta. Nowhere in the prior art is this preferred relationship explicitly taught or suggested. Additionally, the ratio of Na to Ta, as well as their absolute values by wt%, are recited in claim 1. The present specification makes it clear that the beneficial results are not achieved unless both the content and the ratio of claim 1 are used. [0044] to [0049]

Iio merely describes that the amount of Ta can be substituted "in whole or in part" by Nb. This does not describe the relationship that Nb and Tb must share if they are both present in the composition, while also maintaining the proper ratio. Iio fails to describe this relationship, or provide any suggestion or motivation for why the relationship is preferable to merely "substituting" Ta for Nb.

Additionally, the cited reference is silent as to the nature of the processing environment. The product described in claim 1 is processed in an N_2 atmosphere. Iio is largely silent as to the conditions regarding processing. The sole processing information available in Iio is derived from the examples. The examples suggest that the processing conditions included either a vacuum or an inert gas atmosphere. In fact, Iio teaches away from the use of N gas. Iio discloses that in the situations where an N-containing cemented carbide is obtained by sintering in an atmosphere containing nitrogen atoms, it is difficult to produce a surface layer that does not peel off, and hence lacks structural integrity. Furthermore, Iio teaches that it becomes difficult or impossible to control the state of the surface irregularities by controlling the atmosphere in heat treatment of the steps described by Iio. Column 8, lines 1-20 and 54 - 63 of Iio.

Therefore, one skilled in the art would not be motivated to conduct the sintering of the material powders in a nitrogen atmosphere as described in amended claim 1. As such, the cited prior art reference fails to teach the complete invention of claim 1.

Sintering, as defined by the present application, refers to heat treating at a sintering temperature. Claim 1 provides that this sintering takes place in a nitrogen atmosphere. This single

processing step produces a cemented carbide material which has a uniform composition and microstructure. In contrast, Iio describes a two-stage process. The first step involves sintering (heat treatment at the sintering temperature) and a second step of heat treating at a temperature lower than the sintering temperature. As a result of this two stage processing configuration, the WC-based cemented carbide produced by Iio possesses a β(N) phase that is unevenly distributed on its surface. See FIG. 12; Tables 2, 3 and 5 of Iio. As such, those skilled in the art would not be motivated to alter the process described in Iio in order to eliminate the heat treatment stage.

Lastly, the product produced by the prior art reference is believed to be inferior to the present invention because it lacks an even distribution of the β(N) phase on the surface layer of the cemented carbide piece. The N-containing surface layer presents irregularities due to both the formulation of the WC-carbide piece, as well as the temperatures at which the material is formed. Evidence of the incomplete and uneven distribution can be seen in Fig 12, of Iio. Furthermore, Tables 2, 3, and 5 further confirm the uneven nature of the β(N) phase distribution. See column titled "Modified Surface layer presence or not of modified surface layer formed of β(N) phase".

Applicant provides further support for the failure of the prior art to replicate the characteristics of the product described in the present invention in the form of the attached NPL document Hisashi Suzuki, "Cemented Carbide And Sintered Hard Material,"1986, pp.302 -303, (English language abstract attached and herein referenced as "Suzuki reference"). To the best of Applicant's knowledge, the English Abstract is an accurate translation and summary of the subject matter contained within the NPL document. The Suzuki reference provides an analysis of a low carbon, a low-carbon alloy of WC-33.3%; β-12.1%; and Co that is sintered at 1400°C in a vacuum, and then heat treated at 1250°C in N_2 atmosphere having a pressure of 0.9 atm for either one of 3 hours, 6 hours, or 12hours. See FIG. 1.396 (page 303). This process and its conditions are significantly similar to those described in Iio, with the exception of N_2 atmospheric processing. Figure 1.396 clearly shows the resulting microstructure of a cross-section of the alloy. This figure is also reproduced in the English abstract. The results of the process described are a hard layer formed only in the surface, with the inner regions of the alloy lacking sufficient nitride characteristics.

Therefore, the region from the center to the surface of the WC-based cemented carbide piece of Iio fails to posses the specific characteristics of the present invention. In particular, since the

β(N) phase is unevenly distributed in the surface, the β(N) phase does not sufficiently penetrate the inner portion of the WC-based cemented carbide piece. Therefore, the enhanced structural strength of the β(N) phase cannot be obtained in all portions the WC-based cemented carbide piece. As a result superior fracture toughness throughout the material is impossible.

In light of the teaching from Suzuki, even if it were obvious to modify the atmosphere of the prior art with the teaching of the Suzuki reference, the combined teaching still fails to achieve the invention as described in claim 1. Additionally, the Examiner has provided no suggestion or motivation as to how Iio would be obviously modified so as to provide the improved characteristics found in the present invention relating to the various ratios, ranges and processing elements. In fact, the prior art is clearly inferior, and that inferiority is the result of both the differences in processing, as well as the failure to achieve the provided ratio between Nb and Ta as described in amended claim 1.

Accordingly, the cemented carbide material of the present invention is not obvious in light of Iio. In light of the foregoing arguments and amendments, the rejection under 35 U.S.C. §103(a) have been overcome and should be removed. Applicant also notes that claims 3-4 are dependent directly from claim 1. As such, the foregoing arguments render them likewise non-obvious in light of the cited prior art. As such, the 35 U.S.C. § 103(a) rejection that applies to the dependent claims should likewise be removed.

CONCLUSION

In view of the foregoing arguments and claim amendments, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

The Examiner is respectfully requested to contact the undersigned at the telephone number indicated below if the Examiner believes any issue can be resolved through either a Supplemental Response or an Examiner's Amendment. In view of the above amendment, Applicant believes the pending application is in condition for allowance.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, or to credit any overpayment, to Deposit Account No. 50-4570.

Dated: October 11, 2011

Respectfully submitted,

By_____
Jordan Garner
Registration No.: 60,148
LEASON ELLIS LLP.
One Barker Avenue
Fifth Floor
White Plains, New York 10601
(914) 288-0022
(914) 288-0023 (Fax)
Attorneys for Applicants